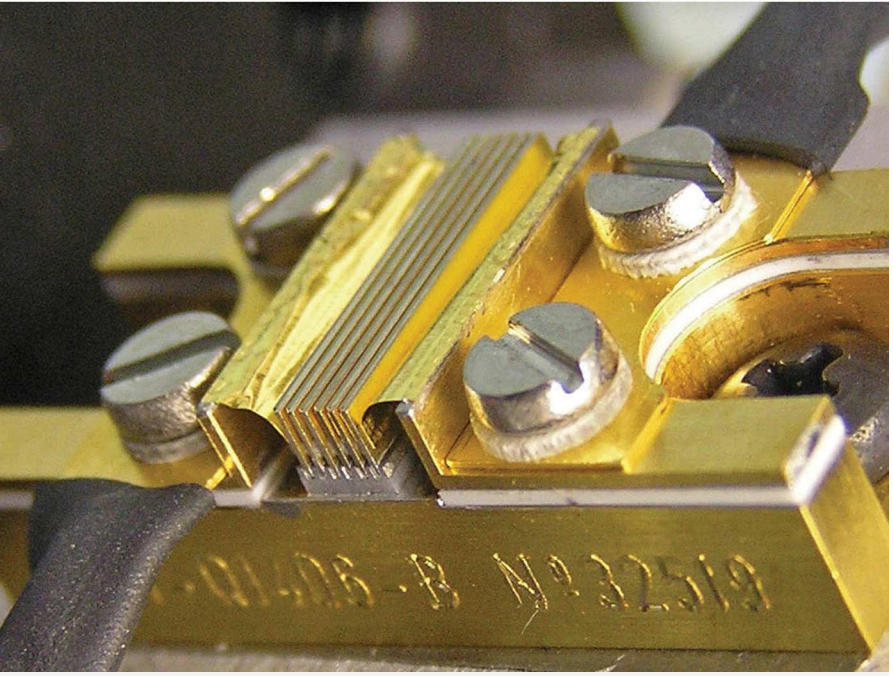


National Aeronautics and Space Administration

technology solution

Sensors

Forward Voltage Short-Pulse Technique

For measuring temperature of laser diode junctions

NASA's Langley Research Center has developed a new technology for measuring the junction temperature of laser diode arrays (LDAs) that can support dramatically improved LDA fault analysis and lifetime estimates. This technology provides better spatial and temporal resolution than spectral chirp or thermal imaging methods and can be integrated into existing LDA systems, such as laser diode drivers, without significant additional costs (including weight, power, and space). Potential applications include quality control and screening of LDAs for maximum lifetime, optimizing development of operational parameters, or providing real-time operational diagnostics/prognostics.

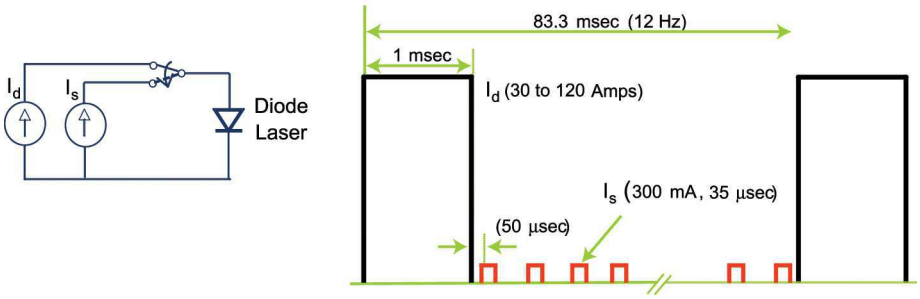
BENEFITS

- Facile and inexpensive way to screen and select an appropriate LDA for use
- Constant diagnostic data on LDA performance for quickly ascertaining malfunction
- Integration of temperature diagnostics into the LDA
- Quick detection of hot spots at junction of LDA bars
- Greater temporal and spatial sensitivity to LDA junction temperatures than spectral chirp or thermal imaging
- Relatively easy to integrate into normal LDA driver
- Low cost, weight, power, and space

THE TECHNOLOGY

NASA's Forward Voltage Short-Pulse Technique provides a novel alternative means to measure LDA junction temperature. Laser diode systems contain a driver that provides nominal quasi-continuous wave pulses. In this technique, a second driver is used to provide precise pulses between operational pulses. This facilitates the accurate derivation of junction temperatures by precisely measuring the voltage of these second pulses. Furthermore, this technique uses small injections of current, and resultantly does not contribute to any heat cycling issues within the LDA.

Thermal cycling is a key mechanical stressor that can cause premature LDA failure. Competing technologies such as spectral chirp and thermal imaging do not provide the speed or spatial resolution to quickly locate hot spots at the junction of the LDA bars. Unlike these technologies, this technique can accurately measure the LDA thermal parameters, and, with little cost, can be easily incorporated into the operation of existing LDAs for real-time junction temperature monitoring. This in turn may facilitate the development of smart laser diode drivers that can adjust operating parameters to LDA conditions.



Example of one possible set of parameters for forward voltage short-pulse measurement

APPLICATIONS

The technology has several potential applications:

- Accurate junction temperature for characterization and evaluation of LDAs used in such diverse fields as:

  -- Telecommunications
  -- Material cutting and welding
  -- Military
  -- Pump sources for any solid state laser
  -- Medical industry

  The technique also provides a means for monitoring the junction temperature of LDAs in operation in order to prolong their lifetime by accordingly adjusting their operational parameters.

PUBLICATIONS

Patent No: 8,112,243

More Information

National Aeronautics and Space Administration

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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